From: Jenny Kay <jekay@mit.edu>
Sent: Tuesday, October 20, 2020 11:30 AM
To: MORASH, MELANIE
Subject: Comment regarding proposed Olin cleanup plan
Attachments: JKay and MIT SRP response to proposed cleanup plan Aug 2020 final.docx

Dear Melanie,

Please find attached my comments regarding the proposed cleanup plan for the Olin Chemical Superfund site. I appreciate the EPA's careful consideration, and I look forward to the effective and thorough remediation of this site.

Best regards,
Jennifer Kay

--
Jenny Kay, Ph.D.
Postdoctoral Research Fellow, Engelward Laboratory
Research Translation Core Director, Superfund Research Program
Center for Environmental Health Sciences
Department of Biological Engineering
Massachusetts Institute of Technology

Comment to the EPA regarding the proposed cleanup plan for the Olin Chemical Superfund Site in Wilmington, MA

The Massachusetts Institute of Technology Superfund Research Program (MIT SRP) appreciates the opportunity to provide feedback regarding the EPA's plan for remediating the Olin Chemical Superfund site, proposed in August 2020. Here, we have integrated expertise from our chemists, environmental engineers, and biologists in consideration of the proposed plan. As a member of the MIT SRP studying biological effects of NDMA exposure, I have included a brief discussion of our important findings regarding genetic susceptibility to NDMA-induced toxicity and cancer.

We are pleased that there are proposed interim actions for remediating the dense aqueous phase liquid (DAPL) pool. Given the complexity of the environmental contamination and potential for continued plume expansion and human exposure, interim action is appropriate. We agree that continued quarterly monitoring of the 18 currently tested wells for nitrosamine contamination is appropriate, but should be expanded to include other nitrosamines and contaminants beyond *N*-nitrosodimethylamine (NDMA) only.

The proposed final actions regarding the light non-aqueous phase liquid (LNAPL) and soil/sediment are not satisfactory to our technical experts. Considering the history of chemical disposal at the site, NDMA precursors and other chemical hazards are likely present in the LNAPL and soil/sediment, and more aggressive assessment and response (e.g., excavation and/or containment) is necessary. Olin manufactured nitrosamine products, namely *N*-nitrosodiphenylamine (aka. Wiltrol N, discussed further below) and a product called "Opex" (dinitrosopentamethylenetetramine), which may be less mobile in the environment than NDMA due to soil sorption, thus necessitating more aggressive soil remediation. The acidity of the site's waste, combined with these manufactured nitrosamines, may create conditions favoring ongoing formation of more mobile nitrosamines (like NDMA) via trans-nitrosation that could continue to leach into the groundwater.

Additionally, numerous nitrosamine precursors or materials known to create nitrosamine-forming conditions are known or highly likely to be present in the LNAPL and soil/sediment, including: hydrazines (which were manufactured at this site); raw materials for Nitropore 5PT (a product formerly manufactured at this site); aqueous ammonia and chlorine (known contaminants in high levels). Organic hydrazine derivatives are well-established precursors for *N*-nitrosamines, but Olin has been vague about their hydrazine manufacturing conditions and methods for treatment and disposal. Nitropore 5PT (aka Expandex 5 PT, 5-phenyltetrazole) manufacturing utilized sodium nitrite, dimethylformamide (DMF), and strong acid; similar conditions were recently found to be the source of NDMA contamination in the blood pressure medication Valsartan, leading to unacceptable levels of human exposure and prompting recall of the drug. Aqueous ammonia and chlorine, which react to form chloramines, are found at

concerningly high levels in both surface and groundwater. Chloramines have long been known to produce nitrosamines from reaction with a wide variety of precursors. All of these chemicals are mobile in the environment and continue to contaminate the site; it is therefore reasonable to expect that these precursors will continue to react and form toxic and carcinogenic *N*-nitrosamines, including NDMA. Over time, this novel formation will reduce the efficacy of efforts to remediate the DAPL and restore the environment of Wilmington. Further, because the slurry wall was not installed to bedrock and leaves opportunity for fluid transport, ongoing NDMA production would continue to contaminate the groundwater of Wilmington until these chemical sources are removed and an effective barrier constructed.

In addition to our concerns about the proposed remedial actions, we would like to call attention to the importance of monitoring additional nitrosamines in the environment. *N*-nitrosamines, a class comprising hundreds of chemicals, are among the most potent carcinogens known. Over 70 *N*-nitrosamines have been documented to cause cancer in animals, and most of them are not currently tested for at the Olin site. For example, *N*-nitrosodiethylamine (NDEA) is even more toxic and carcinogenic than NDMA, and given its structural similarity, it is almost certainly present at the site, but it does not appear to be routinely measured (Nobis OU3 RI report 2019).

One nitrosamine that contaminates the site and should be a substantial concern is *N*-nitrosodiphenylamine (NDPhA) (not to be confused with *N*-nitrosodi-*n*-propylamine, NDPA. Notably, the abbreviation NDPA is used interchangeably for the propyl and phenyl compounds in many reports). NDPhA was manufactured at the site and has been found in the Olin site LNAPL and groundwater. Although NDPhA does not directly damage DNA (whereas NDPA does), it is an EPA class B2 probable carcinogen, and it is a precursor for NDMA (McGregor 1994, *Mutation Research*). Given the relative thermal instability and low volatility of NDPhA, GC/MS (or GC/MS/MS) analysis of this chemical is problematic – NDPhA is expected to decompose at the elevated temperatures required for this approach. Thus, results of NDPhA testing at Olin likely underestimate the true level of contamination. Even so, NDPhA has been found at unacceptably high levels (see EPA/Nobis Engineering letter of disapproval March 2018 RI/FS Deliverables). Given the known contamination of the site with additional nitrosamines, and the potential for even more toxic nitrosamines, it is important to take measures in identifying, monitoring, and remediating other nitrosamines in DAPL, LNAPL, and groundwater.

As a biologist studying the carcinogenic and toxic effects of NDMA, I have seen firsthand how profoundly genetic variability impacts the biological consequences of NDMA exposure. Importantly, the *in vivo* studies that form the basis for federal NDMA health hazard assessments were performed in wild type animals. However, humans are known to vary widely in their genetic capacities for repairing NDMA-induced DNA damage, so existing risk assessments do not account for highly susceptible populations. Given the range of susceptibility for individuals

to suffer toxicity and/or carcinogenicity from NDMA, and the many dangerous *N*-nitrosamines that have not been assayed on the Olin property or in the contamination plume, aggressive cleanup actions are all the more important to protect human health.

As both a member of the MIT SRP and as a concerned citizen, I appreciate the careful consideration of our concerns by the EPA, MassDEP, and Olin, and we look forward to an improved cleanup proposal following this public comment period.